INTRODUCTION

By the term 'Fauna' we mean the total animal life of an area which, together with the plant life ('Flora'), forms the 'Biota'. Faunistic studies are those that deal with the occurrence, prevalence and distribution of the different groups and species of animals in particular geographical areas. The branch of biology which enables us to enumerate, distinguish and name unambiguously the kinds of organisms is 'Taxonomy', which is defined as the theory and practice of classifying organisms (for a full treatment of the principles of animal taxonomy see E. Mayr's Principles of Systematic Zoology, 1969). When we say a particular group (from a particular area) is 'well known' we simply mean that it has been studied well taxonomically.

Some reasons for studying the fauna of a particular region/country are:

(a) The fauna of a country is part of its natural heritage; therefore it is of intrinsic interest to know the kinds of animals and numbers of species that inhabit it.

(b) Analysis of faunal diversity facilitates ecological and zoogeographical studies such as ecosystem description, formulation of diversity indeces, recognition of indicator taxa, and patterns of distribution. Such studies lead to the recognition of key habitat areas and thereby help formulate conservation policies.

(c) The study of a local fauna makes us realise the great genetic diversity that exists in nature, and the biological distinctness of species as unique 'gene pools'. An appreciation of this helps counteract the tendency to overgeneralise in other areas of zoology (e.g. physiology).

(d) A knowledge of the local fauna is necessary for recognition of suitable biological material, in that country, for research into particular problems in fields such as ecology, physiology, genetics, etc.

(e) A knowledge of the local fauna is necessary for the recognition of actually or potentially harmful species (medically, agriculturally) and those that are beneficial (e.g. parasites or predators of pests) as well as species which could be exploited for food, etc.

Historical Background

One of the earliest attempts, in Sri Lanka, at making records of animals for systematic studies was by J.G. Loten, a Dutch governor of Sri Lanka between 1752-1757, who sent paintings of birds and other animals to naturalists in Europe who described and gave them Latin names following the accepted Linnaean system. Later on, especially during the period of British rule, more extensive collections were made in the 1800s by naturalists resident in or visiting Sri

Lanka, such as E.F. Kelaart, E.L. Layard, J. Nietner, and others, who either published descriptions or lists of the species themselves or, more often, sent them to taxonomists working in Europe; thus, institutions such as the British Museum, in London, became important centres for taxonomic research on Sri Lanka's fauna. In 1852 E.F. Kelaart produced his Prodromus Faunae Zeylanicae, which was the first comprehensive account of the vertebrates of Sri Lanka, and in 1861 Sir J.E. Tennent published his Sketches of the Natural History of Ceylon, with a good account of the vertebrates and common invertebrates, plus lists of all the animals known to occur in Sri Lanka at that time. In 1888 the first volume in the series The Fauna of British India, including Ceylon and Burma, under the editorship of W.T. Blanford, appeared and by 1898 all the vertebrate classes had been covered in this series. Numerous volumes by various authors covering many invertebrate groups of animals were also published in this series and new editions of the vertebrate volumes were issued later. The research which produced these volumes was based largely on the collections in the British Museum and since the geographic coverage of the series was wide this work helped to place the fauna of Sri Lanka in its correct setting - as part of the Oriental Zoogeographical Region, in particular the Indian Subregion, but also with many endemic elements of its own. Although many of the 'Fauna' volumes still remain standard taxonomic reference works some of them are now very much out of date, mainly due to insufficient specimens from Sri Lanka at the time at which they were written. By 1950 some 80 volumes had been issued in this series but many inland invertebrate groups and all marine invertebrates had not been covered. Commercial interest in exploiting the pearl oyster fishery in the Gulf of Mannar resulted in a marine biological investigation which gave rise to the Report to the Government of Ceylon on the Pearl Oyster Fisheries of the Gulf of Mannar, edited by W.A. Herdman in 5 volumes between 1903-1906, with several important taxonomic reports on Sri Lanka's marine fauna.

During the 20th century much more extensive collecting by W.W.A. Phillips, G.M. Henry, and P.E.P. Deraniyagala, and others, took place, resulting in the vertebrate fauna in particular being one of the best known taxonomically in south Asia. In 1962 P. Brinck and two colleagues from Lund University in Sweden visited Sri Lanka on an extensive collecting expedition, and between 1969-1980 the Smithsonian Institute's 'Biosystematic Studies of Ceylonese Insects' project, under K.V. Krombein, was in operation. In 1970 a joint Austrian-Sri Lankan hydrobiological mission, under F. Starmuhlner and H.H. Costa, took place. The published taxonomic results of these projects, plus the work of C.H. Fernando and others on freshwater invertebrates, has greatly increased our knowledge of the fauna of Sri Lanka, but some terrestrial invertebrates and most marine invertebrates still remain very imperfectly known.

Physical Features and Zoogeography of Sri Lanka

Physical Faetures:

Sri Lanka is a continental island of the Indian subcontinent, situated between longitudes E 79°39' and 81°53' and latitudes N 5°54' and 9°52', with a surface area of 65,610 km^2. It was part of India upto the Miocene, and formed part of the ancient land-mass, Gondwanaland, in pre-Triassic ages. The surface of the island consists of three peneplains, with average altitudes of 30m, 500m and 1,500-1,800m. The most important climatic factors are the SW-monsoon (May-September) and the NE-monsoon (December-February), and their interaction with the topography of the island leads to a precipitation pattern dividing the country into two broad zones: the Dry Zone (the northern half of the island plus the eastern lowlands) and the Wet Zone (the southwestern lowlands and most of the hills). Many attempts have been made to subdivide the island into more precise natural zones, based on climate (rainfall & temperature) and/or vegetation and different authors have recognised a number of zones ranging from 4 to 22. Following recent authors (e.g. Dittus 1977, Erdelen 1984), based on the earlier work of Gaussen et al. (1965 & 1968) and especially Mueller-Dombois (1968), 4 main climatic-vegetational zones may be recognised: Zone A (Monsoon Scrub Jungle), Zone B (Semi-evergreen Monsoon Forest), Zone C (Intermediate Forest) and Zone D, which is subdivided further according to altitude: 0-915m (Lowland Evergreen Rain Forest), 915-1525m (Montane Forest), and over 1525m (Cloud Forest); these subzones are sometimes referred to as D_1, D_2 and D_3, respectively.

Zone A: Consists of two portions, the northern & north-western coastal area (A_1) and the south-eastern coastal area (A_2). Also known as the 'Arid Zone', this contains the driest areas of the island.

Zone B: Much of what is generally regarded as Dry Zone consists of this zone.

Zone C: This is the transitional area between the Dry Zone and Wet Zone. The boundary between Zones C & D is roughly equivalent to the Wet Zone/Dry Zone boundary.

Zone D: This is the true rain forest region of Sri Lanka, dominated by Dipterocarp forests in the lower and middle elevations. Numerous streams and rivers originate in the hills and flow to the coast through this region.

Zoogeography:

As we would expect the fauna of Sri Lanka is very similar to that of south India. If Sri Lanka is 'fitted' to the coast of southern India it is seen that the Wet Zone of Sri Lanka is merely the southernmost extremity of the the humid Western Ghats mountain range of India and similarly the Dry Zone

of Sri Lanka is essentially an extension of the dry lowlands of eastern southern India. These two regions of peninsular India - the rain forest areas of the Western Ghats and drier lowlands east of them - are sometimes known as the 'Malabar Tract' and the 'Carnatic Tract', respectively, and are the biogeographical equivalents of the Wet Zone and Dry Zone of Sri Lanka. The other major areas of rain forest in India occur along the Eastern Himalayas and in the regions north, north-east, and east of the Bay of Bengal, and these extend into much of the Indo-Malayan and Malaysian subregions of the Oriental Region. The major forest type in the Indian peninsula is Tropical Dry Deciduous forest and Tropical Thorn forest occurs in the dry, almost desert-like, areas in the north-western plains.

Many zoologists from the earliest times have been aware of the close similarity in the fauna of the south-west of India and the south-west of Sri Lanka, and the close relationship between these faunas and the faunas of the Eastern Himalayas and the rainforest areas of South-East Asia. This similarity consists of the occurrence of certain chacteristic genera or species and is often referred to as the 'Malayan Element' in the fauna of the Indian Subregion. There are two main theories which attempt to explain this phenomenon:
(a) According to this theory, first put forward by the Indian ichthyologist Sunder Lal Hora and followed by the American ornithologist S. Dillon Ripley (1949), the Malayan element of the fauna was able to 'invade' the south-west of India (and Sri Lanka) through a series of hill ranges connecting the northern tip of the Western Ghats with the Garo Hills in the Assam area. These hill ranges acted as a 'biogeographical highway', enabling certain groups to spread to the Western Ghats and Wet Zone of Sri Lanka and presumably had a climatic-vegetational continuum between the rain forests of Assam etc. and south west India, distinct from the rest of the Indian peninsula. This southward invasion was favoured especially during cooling of the climate (e.g. Pleistocene glaciations) and lowering of the sea level (water locked as ice in the north), thereby causing land connections between India and Sri Lanka to form. According to this theory, therefore, the 'Malayan Element' is a more recent component of the total fauna of these areas.
(b) A more recent and more widely accepted theory is that coherently first put forward by the Indian entomologist M.S. Mani (1974). According to this theory rain forests and associated fauna were more extensively distributed under milder climatic conditions. However, the present day fauna of the Indian subcontinent is a greatly impoverished one and this has been caused by several factors, including general deterioration of the climate and the destruction of natural cover within historical times. Under such circumstances

areas such as the Wet Zone of Sri Lanka and the Malabar Tract of India have acted as refuges for species or groups of plants and animals less tolerant of adverse climatic conditions. Thus the high precipitation rain forest areas of India and Sri Lanka are 'islands' in the ecological sense, a relict habitat with associated relict taxa of animals.

Endemic Fauna:

The endemic vertebrate fauna will be dealt with in greater detail below in the relevant sections, but a few general remarks are necessary here. Following Crusz (1984) endemicity is defined as follows: 'An endemic species is one that is confined to a particular region and is found nowhere else, chiefly owing to geographic isolation'. Two other terms, relic and relict, used in zoogeographic discussions may be defined as follows: "Relics are living remnants of a main stock (or of basal lines of evolutionary branches) which has differentiated elsewhere. They are living fossils in the palaeontological sense". "Relicts are living representatives of environments that have disappeared for various reasons. They are therefore living fossils in the biogeographical or ecological sense" (Crusz 1984).

Broadly, a species of animal could be an endemic in one of three possible ways:

(i) It may have originated and always been restricted to Sri Lanka in its distribution. This would apply especially to species with very low powers of dispersion.

(ii) It may have ocurred in South India and Sri Lanka but due to various reasons the population outside Sri Lanka may have become extinct, leaving the species as an endemic of Sri Lanka.

(iii) An ancestral species may have been widely distributed within and outside Sri Lanka. After the isolation of Sri Lanka from India further phylogenetic differentiation would lead to a distinct endemic species in Sri Lanka which, however, may have one or more close relatives outside the island.

The majority of Sri Lanka's endemic fauna occur in the Wet Zone. Senanayake et al. (1977), who divide the island into 4 regions based on the Wet Zone/Dry Zone dichotomy plus the three peneplains, showed that the majority of endemic vertebrates occur in the mountainous regions of the Wet Zone. Considering the high degree of endemicity in these regions of relatively small surface area these authors assigned high 'Habitat Values' to these regions. These authors argue that the montane zones represent the most conservative elements of the Sri Lankan fauna, those that have been least influenced by recent invasions from the Indian mainland. The paucity of endemics in the lowlands (especially drier areas) is in large part a consequence of periodic land bridge connections to South India in the Pleistocene and the episodic exchange of lowland biotas.

References:

Brinck, P., Andersson, H., & Cederholm, L. (eds.) 1971-82. Reports from the Lund University Ceylon Expedition in 1962, Vols.I-III. Entomologica Scandinavica, Supplements 1, 4 & 11.

Crusz, H. 1984. Parasites of the endemic and relict vertebrates: a biogeographical review. In Fernando, C.H. (ed.) 1984: 321-351.

Dittus, W.P.J. 1977. The ecology of a semi-evergreen forest community in Sri Lanka. Biotropica 9(4): 268-286.

Erdelen, W. 1984. The genus Calotes (Sauria, Agamidae) in Sri Lanka: distribution patterns. Journal of Biogeography 11: 515-525.

Fernando, C.H. (ed.) 1984. Ecology and Biogeography in Sri Lanka. W. Junk, The Hague.

Gaussen, H., Legris, P., Viart, M., & Labroue, L. 1965. International Map of the Vegetation and of Environmental Conditions. Survey Dept., Colombo.

Gaussen, H., Legris, P., Viart, M. & Labroue, L. 1968. Explanatory Notes on the Vegetation Map of Ceylon. Govt. Press, Colombo.

Krombein, K.V. 1980. The Smithsonian Insect Project in Sri Lanka, 1969-75. Spolia Zeylanica 35: 119-133.

Mani, M.S. 1974. Ecology and Biogeography in India. W. Junk, The Hague.

Mueller-Dombois, D. 1968. Ecogeographic analysis of a climate map of Ceylon with particular reference to vegetation. Ceylon Forester 8(3&4): 39-58, & folding map.

Ripley, S.D. 1949. Avian relicts and double invasions in peninsular India and Ceylon. Evolution 3(2): 150-159.

Senanayake, F.R., Soule, M. & Senner, J.W. 1977. Habitat values and endemicity in the vanishing rain forests of Sri Lanka. Nature 265: 351-354.

Starmuhlner, F. et al. 1972-74. Results of the Austrian-Ceylonese Hydrobiological Mission 1970...Bulletin of the Fisheries Research Station of Sri Lanka 23-25.